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This study at George Washington University tested for the dependence of the graduate quality point index on total scores of the Admission Test for Graduate Study in Business (an aptitude test), undergraduate quality point index, and length of time since receiving the bachelor's degree. It was hypothesized that success in the Graduate Business School is independent of all three of these variables. Subjects were 104 adult part-time graduate students admitted to the Master's program administered by the College of General Studies from September 1967 to May 1968. Principal data included the above named major variables and the number of graduate semester hours completed. Despite limitations in the study, it was concluded that success in the Graduate Business School is independent of all three major variables. However, academic workload and other factors may also be influential. (Three tables, three methodological appendixes, and seven references are included.) (ly)

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THE ADMISSION TEST FOR GRADUATE STUDY IN BUSINESS AND THE ADULT PART-TIME STUDENT

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CHAPTER I

PURPOSE AND ORGANIZATION

I. PURPOSE OF THE STUDY

Commencing with the academic year 1967-68, The George Washington University required all applicants for Master's candidacy in the College of General Studies to take the Admission Test for Graduate Study in Business (ATGSB) prior to admission.

The objective of the test is to help select candidates with reasonable chance of success in graduate business studies as reflected by the graduate quality point index.

The purpose of this study is to test for the dependence of the graduate quality point index on each of the following: 1) total scores of the Admission Test for Graduate Study in Business; 2) undergraduate quality point index; and, 3) length of time since the student received his bachelor's degree.

The George Washington University is one of the largest users of the examination. The part-time adult student body and the ATGSB have generated considerable controversy relative to specifics mentioned above and the test as an indicator of success in graduate business school.

II. ADMISSION TEST FOR GRADUATE STUDY IN BUSINESS

A. Origin and Sponsorship of the Test

The Admission Test for Graduate Study in Business was

developed and is administered by The Educational Testing Service, Princeton, New Jersey, under the direction of a Policy Committee composed of representatives from business schools that have agreed to participate in the program.

The test was first administered in 1954. More than 234,000 candidates have now taken the test, and several studies of the usefulness and accuracy of the test have been made.

B. Nature of the Test

The test itself is an aptitude test designed to indicate potential success in graduate training in business. It is not a measure of achievement or knowledge in specific subject matters; it does not presuppose a background in business administration. It is a three-hour and forty minute aptitude test designed to measure certain abilities that have been found to be important in the study of business at the graduate level. It contains questions that test a student's ability to read, to understand, and to reason logically with a variety of verbal and quantitative material.

C. Nature of the Reported Scores

During the first year the test was given, a total raw score for the test was reported. From February, 1955 through September 1956, the total score on the test was reported on a standard scale. Candidates in all subsequent administrations have three scores reported: verbal, quantitative, and total.

The verbal and quantitative scores can range from 0 to 60, although scores below 12 to above 48 are quite rare; about two-thirds of all the candidates tested are expected to have scores between 22 and 38. The total scores with a mean of 511.75 in this study, ranged from 275 to 724.

The three reported scores have been equated for different forms of the test. For security reasons, the same characteristics are measured by using three different forms of the test. Therefore, it is possible to compare scores obtained at different administrations and on different forms of the test.

D. Interpretation of the Scores

There are three things which should be considered when using test scores: 1) the usefulness of the scores in predicting future success in the particular business school to which the applicant is applying for admission (validity); 2) the similarity of the score obtained if the same candidates had taken a different, but parallel, form of the test (reliability); and, 3) the performance on the test of other applicants for admission to graduate study in business (norms).

E. How Schools Arrange to Use the Test

Any school, regardless of Policy Committee Membership, may require or recommend that its applicants for graduate study take the test. The school need only notify its applicants that they should take the test, that it is necessary to make arrange-

ments with The Educational Testing Service to take it, and that they should request that score reports be sent to the school. Normally, the test is administered five times annually.[1]

III. HYPOTHESES TO BE TESTED

Three specific hypotheses were tested in the present study. These hypotheses are indicated below and will be discussed in the overall analysis of the data.

Hypothesis I

Success in the Graduate Business School is independent of the Admission Test for Graduate Study in Business.

Hypothesis II

Success in the Graduate Business School is independent of length of time since bachelor's degree was received.

Hypothesis III

Success in the Graduate Business School is independent of undergraduate quality point index.

IV. SCOPE OF THE STUDY

The Educational Testing Service has conducted a wide variety of studies with the Admission Test for Graduate Study in Business.

The scope of this study is based on a random sample of 104 part-time adult graduate students out of a total of 437, who were admitted to the Master's program administered by the College of General Studies from September 1967, to May 1968.

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[1] Admission Test for Graduate Study in Business Memorandum Transmitting Scores to Business Schools, 1967-68.

V. LIMITATIONS OF THE STUDY

Certain limitations restrict the inferences and conclusions which can be drawn from the present study.

In essence, the primary limitation was the time frame allotted this study. A larger sample size from the universe of 437 students would serve as a more reliable predictor.

One hundred and nine student files were randomly selected; however, only 67 files were usable because, for practicable considerations, only students with more than three credit hours were required, and information in other cases was not available.

Conclusions drawn from this study should be interpreted in view of the above.

CHAPTER [illegible]

DATA COLLECTION PROCEDURE

The College of General Studies maintains a student file for each graduate degree candidate. In discussion with the Staff Associate for Student Records, he indicated that a total of 437 students had taken the Admission Test for Graduate Study in Business from September 1967, through May 1968. However, our sample indicates that about 5% of this number did not actually take the Admission Test for Graduate Study in Business, but took a similar examination, the Graduate Record Examination. In addition, a 3x5 card is typed for each student file which serves as a cross index. These cards are filed alphabetically.

A decision was made to conduct a simple random sample of the universe. The random sample size was determined by use of the formula and table for field size of 500 extracted from Arkin.[1] His tables were developed to avoid time-consuming computations. Based on practical considerations of available resources, and a universe of 437, we used a sample of 109 instead of his, based on the following formula: $n = \frac{1}{R^2/t^2 + 1/N} = 120$ (where R = ratio of sampling error to standard deviation, t = factor determined by confidence level, n = sample size, and N = population size).

One hundred and nine (109) student files were selected by the

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[1]Arkin, Herbert, Handbook of Sampling For Auditing and Accounting, Vol. I - Methods (New York: McGraw-Hill Book Company, 1963). Random sample size formula: $n = \frac{1}{R^2/t^2 + 1/N}$ p. 605; tables, p. 406.

following method. Each 3x5 card was numbered in the upper right hand corner from 1 to 437. A table of random numbers[2] was used to select the sample in order to insure that every item in the universe had an equal chance of being included. The selected random numbers were matched with the same number on the 3x5 cards. The files were then drawn from the information reflected on the cards.

A chart was used to record the following data: random number, name, student number, semester hours completed and grades obtained, number of semester hours completed each semester, date undergraduate degree received, undergraduate degree received, undergraduate and graduate quality point index, age, Admission Test for Graduate Study in Business Scores - verbal, quantitative and total, and date student was admitted to program. (see Appendix C for model of chart).

All of the above data were not used in this study but were collected as a matter of convenience for possible future additional analysis.

Data specifically used in this study include: total Admission Test for Graduate Study in Business scores; length of time since undergraduate degree; undergraduate and graduate quality point index; and graduate semester hours completed.

The data were recorded in the order that the random numbers were selected.

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[2]Table of Random Numbers, "A Thousand Random Digits", Springer, Herlihy, Mall, and Beggs, Statistical Inference, (Illinois: Richard D. Irwin, Inc., 1966).

CHAPTER III

OVERALL ANALYSIS OF THE DATA

I. METHOD OF STATISTICAL ANALYSIS

The current study used the chi-square distribution primarily, in making the various statistical tests.

Tables I, II, and III were constructed to perform the necessary contingency table tests. Details of the chi-square tests are described below.

The chi-square distribution is used to test actual versus theoretical distribution and is particularly appropriate when analyzing frequencies within classifications.

As indicated previously, the chi-square tests for independence of graduate quality point index were made with respect to each of the following:

A. Total Admission Test for Graduate Study in Business score,

B. Undergraduate quality point index,

C. Length of time since bachelor's degree.

For the time being, we shall call these variables A, B, and C, as listed above. The three variables were placed into the following class intervals:

VARIABLES	INTERVALS	
A	Below 50	50+
B	Below 2.39	2.40+
C	1 - 9 Yrs.	10+

To test for independence, we set up contingency tables and used the chi-square statistic, $X^2 = \sum \frac{(f_o - f_c)^2}{f_c}$; the continuity correction was omitted. The frequencies were computed for each cell in each table in the usual manner, employing marginal totals. For example: in Table I, the entries in brackets of each cell are the expected frequencies (f_c). The expected frequency for a single cell in Table I was computed as follows: the marginal number of students in the first column (35) were divided by the grand total (67) and multiplied by the marginal total for the first line (36), e.g., $f_c = \frac{35}{67}(36) = (18.81)$. Tests of independence were based on chi-square values at the .05 significance level depending upon the appropriate degrees of freedom.

The results are given at the bottom of each contingency table.

Regardless of the significance, one may still be able to find an association by other means such as linear regression - the average relationship between two variables based on a straight line.

TABLE I

CHI-SQUARE CONTINGENCY TEST

GRADUATE QUALITY POINT INDEX

TOTAL ATGSB SCORES PERCENT	3.50+	3.25 - 3.49	Below 3.24	TOTAL
50+	20 = f_o (18.81) = f_c	6 = f_o (6.44) = f_c	10 = f_o (10.75) = f_c	36
BELOW 50	15 = f_o (16.19) = f_c	6 = f_o (5.56) = f_c	10 = f_o (9.25) = f_c	31
TOTAL	35	12	20	67

1. H_o: The distribution of the Graduate Quality Point Index is independent of the total ATGSB scores.
   H_1: They are related.

2. $\alpha = .05$

3. $X^2 = .31$
   df = 2

4. Region of rejection: $X^2 \geq 5.99$

Decision: Accept null hypothesis

Conclusion: Graduate QPI appears to be independent of ATGSB scores.

TABLE II

CHI-SQUARE CONTINGENCY TEST

GRADUATE QUALITY POINT INDEX

UNDERGRADUATE QUALITY POINT INDEX	3.50+	3.25 - 3.49	Below 3.24	TOTAL
2.40+	28 = f_o (24.56) = f_c	7 = f_o (8.42) = f_c	12 = f_o (14.02) = f_c	47
BELOW 2.39	7 = f_o (10.44) = f_c	5 = f_o (3.58) = f_c	8 = f_o (5.98) = f_c	20
TOTAL	35	12	20	67

1. H_o: The distribution of the Graduate Quality Point Index is independent of the Undergraduate Quality Point Index.
   H_1: They are related.

2. $\alpha = .05$

3. $X^2 = 3.37$
   df = 2

4. Region of rejection: $X^2 \geq 5.99$

Decision: Accept the null hypothesis

Conclusion: Graduate QPI appears to be independent of undergraduate QPI.

TABLE III

CHI-SQUARE CONTINGENCY TEST

GRADUATE QUALITY POINT INDEX

LENGTH OF TIME SINCE BACHELOR'S DEGREE	3.50+	3.25 - 3.49	Below 3.24	TOTAL
1 - 9 YEARS	24 = f_o (20.89) = f_c	5 = f_o (7.16) = f_c	11 = f_o (11.95) = f_c	40
10+ YEARS	11 = f_o (14.11) = f_c	7 = f_o (4.84) = f_c	9 = f_o (8.05) = f_c	27
TOTAL	35	12	20	

1. H_o: The distribution of the Graduate Quality Point Index is independent of the length of time since the Bachelor's degree.
   H_1: They are related.

2. $\alpha = .05$

3. $X^2 = 2.81$
   $df = 2$

4. Region of rejection: $X^2 \geq 5.99$

Decision: Accept null hypothesis

Conclusion: Graduate QPI appears to be independent of length of time since Bachelor's degree.

The sample mean and standard deviation of the Admission Test for Graduate Study in Business examinees in this study were computed and compared with the national mean and standard deviation of the 43,652 tested in academic year 1966-67 (see Appendices A and B).

In general, the mean is the one score or measure which best describes the quality of the group as a whole.

The standard deviation is a measure of the spread or extent of variability of a set of scores around their mean. It can be thought of as a measure of the degree of homogeneity of the group with respect to the variable in question.

Based on the assumption that the sample values were drawn from a normal population, a t and X^2 test could have been conducted for the mean and standard deviation. However, the use of the t and X^2 test was not appropriate in this study in making a decision of whether to accept or to reject the given hypothesis about the national mean and standard deviation. This study included only those students with acceptable Admission Test for Graduate Study in Business scores to the College of General Studies; the national was all inclusive.

II. HYPOTHESIS I TESTED

On the basis of the data presented in Table I, Hypothesis I was tested.

Hypothesis I

Success in the graduate business school is independent of the Admission Test for Graduate Study in Business.

The computed chi-square value of .31 which is far below the tabled X^2 of 5.99 from the tabular chi-square with 2 degrees of freedom at the .05 level of significance, indicates that the graduate quality point index is independent of total Admission Test for Graduate Study in Business scores.

III. HYPOTHESIS II TESTED

On the basis of the data presented in Table III, Hypothesis II was tested.

Hypothesis II

Success in the graduate business school is independent of length of time since bachelor's degree was received.

The computed chi-square value of 2.81 on Table III is well below the tabled value of 5.99 with 2 degrees of freedom. Graduate quality point index is independent of length of time since bachelor's degree.

IV. HYPOTHESIS III TESTED

On the basis of the data presented in Table II, Hypothesis III was tested.

Hypothesis III

Success in the graduate business school is independent of

undergraduate quality point index.

The computed chi-square value of 3.37 on Table II is below the tabled value of 5.99 with 2 degrees of freedom. Graduate quality point index is independent of undergraduate quality point index.

CONCLUSIONS

The findings of the present study strongly support the null hypotheses stated above. The variables differ statistically relative to cell frequencies. However, one must consider such comparisons as the combinations within each cell relative to semester hours completed, i.e., the academic workload. For example, the number of hours completed per semester by a student may have a tendency to lower his quality point index. To the contrary, a student registered for only one course each semester may do far better in terms of graduate quality point index.

To compound this problem, other variables may affect the part-time adult student that do not affect the full-time student. Many of these variables may be classified as imponderables.

In summary, a detailed analysis of the adult part-time student relative to his academic load and outside obligations such as family, job, etc., may account for quality point index fluctuations.

The comparison of the national and sample means reflect no significant difference considering size of the national and sample (see Appendix A); however, College of General Studies students' mean of 511.75 is 25.75 points higher than the national mean.

Information obtained from The Educational Testing Service:

was that a national student scoring a 600 total score on the national table fell into the 88th percentile while we found that OUR student fell into approximately the 82nd percentile. We were approximately 5% - 10% higher than the national tabulation. In addition, approximately 20% of the College of General Studies students scored 600 or better, while approximately 4% scored in the lower register, under 375.

The sample standard deviation was 87.5 - a difference of 10.5 less than the national.

A major factor deduced from the above discussion may be due to the size of the sample (109) relative to the size of the national (43,652), and the fact discussed earlier that the national was an all-inclusive study.

It should be noted that the variance in sample sizes in Appendices A and B was due to the fact that from the sample of 109, two had taken the Graduate Record Examination, while three had no reported scores.

CHAPTER IV

SUGGESTIONS FOR ADDITIONAL RESEARCH

A great deal can be learned about how much reliance to place on any one predictor relative to others used in evaluating applicants. Best weights to use when combining predictors can vary widely from school to school, and only a study carried out within a school can determine the optimal weights for its purposes.

The different variables involving full-time students versus the adult part-time students suggest that additional research is needed before the Admission Test for Graduate Study in Business is either accepted, refined, or rejected. The present study also uncovered several areas where additional research seems merited.

A useful research project might be developed by studying a larger sample size of students.

Further research might incorporate the acceptance of a different range of total scores for different age groups, length of time since bachelor's degree, semester hours carried by various classifications of students during an academic year, etc.

If possible, it may be best to have the study conducted within the Admissions Office which may result in far-reaching changes and insight into the various elements of the admissions system. Improved admissions procedures may well result.

Future research should encompass larger samples with possible consideration of other variables.

While the results of this study suggest possible basis for action, it should be viewed with extreme caution. This study is presented for the interest of knowledgeable administrators who may find that it confirms or denies the teachings of their own experience but who will, in any case, want to reflect on them. Each student may be a unique case and should be evaluated accordingly. The danger lies in using the same yardstick for the full-time student and the adult part-time student.

APPENDIX A

SAMPLE MEAN OF ADMISSION TEST FOR GRADUATE STUDY IN BUSINESS SCORES

Total ATGSB Scores	Mid-Point x_i	Frequency f	fx_i
250-274	262	1	262
275-299	287	0	0
300-324	312	1	312
325-349	337	1	337
350-374	362	1	362
375-399	387	5	1935
400-424	412	8	3296
425-449	437	7	3059
450-474	462	11	5082
475-499	487	10	4870
500-524	512	18	9216
525-549	537	9	4833
550-574	562	8	4496
575-599	587	5	2935
600-624	612	5	3060
625-649	637	9	5733
650-674	662	1	662
675-699	687	3	2061
700-724	712	1	712
		104	53,223

Sample Mean: $\bar{X} = \frac{fx_i}{n} = 511.75$

	National Population	Sample
Mean	486	511.75
Standard Deviation	98	87.5
Number of Candidates	43,652	104

APPENDIX B

STANDARD DEVIATION OF SAMPLE

ADMISSION TEST FOR GRADUATE STUDY IN BUSINESS

Total ATGSB Scores	Frequency f	Coded Variable u_i	$f_i u_i$	$f_i u_i^2$
250-274	1	- 9	- 9	81
275-299	0	- 8	0	0
300-324	1	- 7	- 7	49
325-349	1	- 6	- 6	36
350-374	1	- 5	- 5	25
375-399	5	- 4	- 20	80
400-424	8	- 3	- 24	72
425-449	7	- 2	- 14	28
450-474	11	- 1	- 11	11
500-524	18	1	18	18
525-549	9	2	18	36
550-574	8	3	24	72
575-599	5	4	20	80
600-624	5	5	25	125
625-649	9	6	54	324
650-674	1	7	7	49
675-699	3	8	24	192
700-724	1	9	9	81
TOTAL	104		103	1359

Standard Deviation

$$s = h \frac{n f_i u_i^2 - (f_i u_i)^2}{n (n - 1)} = 87.5$$

	National Population	Sample
Mean	486	511.75
Standard Deviation	98	87.5
Number of Candidates	43,652	104

APPENDIX C

Random Number	Student Name and Number	Birth Date	Date Undergraduate Degree Received and Institution	Undergraduate Quality Point Index	ATGSB Scores Verbal, Quantitative Total	Date Admitted to GWU Graduate Program	GWU Graduate Quality Point Index	GWU Graduate Semester Hours Completed Per Semester	Total GWU Graduate Hours Completed

MODEL CHART

WORKSHEET FOR DATA COLLECTION

MODEL CHART

WORKSHEET FOR DATA COLLECTION

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